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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
LAMARRE, GUY J	

ART UNIT	PAPER NUMBER
2133	

DATE MAILED: 07/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/693,986	PARK ET AL.	
	Examiner	Art Unit	
	Guy J. Lamarre	2133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/28/03+2/1/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The Examiner has considered the Applicant's IDS of 10/28/03 & 2/1/06.

2. Pursuant to 35 USC 131, **Claims 1-24** are presented for examination.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3.1 **Claims 1-24** are rejected under 35 U.S.C. 102(b) as being anticipated by **Amelia** (US Patent No. 6,351,838; issued 02/26/2002).

As per Claims 1-24, **Amelia** discloses, in Fig. 2 and related description, equivalent multidimensional storage system comprising multiple disk drives along with plural dimensional error detection/correction/protection along with appropriate controller capability, e.g., Amelia's '*FIG. 2 shows symmetrical three-dimensional parity protection system schematically as diagram 51 embodied by frame 53, with three two-dimensional planes 55, 57 and 59 with each plane containing conventional data storage disk drives such as disk drive 61 and parity protection disk drives for secondary storage data such as drive 63. In this simplified embodiment, each of the flat plane arrays 55, 57 and 59 are similar to the two-dimensional system shown in FIG. 1, and are connected similarly within each plane, but additionally, each flat plane has all of the drives connected to the other planes in a Z axis manner to create a three-dimensional parity protection system such as described above.*'

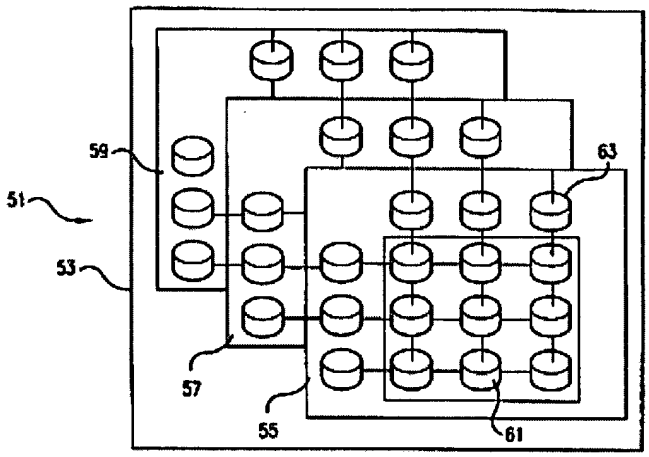

FIG. 2

As per Claim 1, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** parity storing method in an external storage subsystem comprising multiple disk drives including a plurality of storage blocks, comprising: determining a number of the storage blocks to be used as data blocks and a number of the storage blocks to be used as parity blocks in a total number of storage blocks of the disk drives; forming a three-dimensional block matrix of virtual data blocks corresponding to the determined number of the storage blocks to be used as the data blocks on Cartesian coordinates (X, Y, Z); allocating virtual parity blocks to block planes related to the X, Y and Z-coordinates of the three-dimensional block matrix, respectively; allocating the virtual data blocks and the virtual parity blocks to the storage blocks of the disk drives, respectively; calculating parity information based upon data bits respectively stored in the storage blocks corresponding to the virtual data blocks of every block plane; and storing the calculated parity information in the storage blocks corresponding to the virtual parity blocks for every block plane, respectively.

As per Claim 2, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** parity storing method according to claim 1, wherein the number of the

storage blocks to be used as data blocks and the number of the storage blocks to be used as parity blocks are determined by calculating a maximum integer M satisfying K.gtoreq.M.sup.3+3M, where K is the total number of storage blocks of the disk drives, so that the number of the data blocks is defined as M.sup.3 and the number of the parity blocks is defined as 3M and the three-dimensional block matrix is a type of M.times.M.times.M.

As per Claim 3, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** parity storing method according to claim 1, wherein the allocating of the virtual data blocks and the virtual parity blocks to the storage blocks of the disk drives is performed by allocating the virtual parity block for each block plane to the storage block of the disk drive after the virtual data blocks belonging to each block plane are completely allocated to the storage blocks of the disk drives.

As per Claim 4, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** parity storing method according to claim 1, wherein the calculating of the parity information is performed by a bitwise operator performing exclusive OR (XOR) operation between the data bits stored in the storage blocks corresponding to the virtual data blocks of each block plane.

As per Claim 5, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** error block recovery method in an external storage subsystem comprising multiple disk drives including a plurality of storage blocks, comprising: storing data and parity information by the parity storing method according to claim 1; and recovering a plurality of error blocks by using parity blocks corresponding to the virtual parity blocks related to the respective block planes with the error blocks of X, Y and Z-coordinates.

As per Claim 6, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** n error block recovering method in an external storage subsystem comprising

multiple disk drives including a plurality of storage blocks, comprising: storing data and parity information by the parity storing method according to claim 2; and recovering a plurality of error blocks by using the parity blocks corresponding to the virtual parity blocks related to the respective block planes with the error blocks of X, Y and Z-coordinates. **As per Claim** 7, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** n error block recovering method in an external storage subsystem comprising multiple disk drives including a plurality of storage blocks, comprising: storing data and parity information by the parity storing method according to claim 3; and recovering a plurality of error blocks by using the parity blocks corresponding to the virtual parity blocks related to the respective block planes with the error blocks of X, Y and Z-coordinates. **As per Claim** 8, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** n error block recovering method in an external storage subsystem comprising multiple disk drives including a plurality of storage blocks, comprising: storing data and parity information by the parity storing method according to claim 4; and recovering a plurality of error blocks by using the parity blocks corresponding to the virtual parity blocks related to the respective block planes with the error blocks of X, Y and Z-coordinates. **As per Claim** 9, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** error block recovering method according to claim 5, wherein the recovering the plurality of error blocks comprises: counting the total numbers of the error blocks occurring in the block planes, respectively; skipping the block planes with no error blocks or with two or more error blocks performing an exclusive OR (XOR) operation between the data bits stored in the storage blocks, except for an error block, corresponding to the virtual data blocks belonging to each block plane with one error block; recovering the one error block by comparing XOR operation results with the parity information stored in the storage block corresponding to the

parity block for the block plane; and repeating the above recovering operations in regular order of the X, Y and Z-coordinates.

As per Claim 10, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** error block recovering method according to claim 6, wherein the recovering the plurality of error blocks comprises: counting the total numbers of the error blocks occurring in the block planes, respectively; skipping the block planes with no error blocks or with two or more error blocks each block plane with one error block; recovering the one error block by comparing XOR operation results with the parity information stored in the storage block corresponding to the parity block for the block plane; and repeating the above recovering operations in regular order of the X, Y and Z-coordinates.

As per Claim 11, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** error block recovering method according to claim 7, wherein the recovering the plurality of error blocks comprises: counting the total numbers of the error blocks occurring in the block planes, respectively; skipping the block planes with no error blocks or with two or more error blocks performing an exclusive OR (XOR) operation between the data bits stored in the storage blocks, except for an error block, corresponding to the virtual data blocks belonging to the block plane with one error block; recovering the one error block by comparing XOR operation results with the parity information stored in the storage block corresponding to the parity block for the block plane; and repeating the above recovering operations in regular order of the X, Y and Z-coordinates.

As per Claim 12, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** error block recovering method according to claim 8, wherein the recovering the plurality of error blocks comprises: counting the total numbers of the error blocks occurring in the block planes, respectively; skipping the block planes with no error blocks or with two or

more error blocks performing an exclusive OR (XOR) operation between the data bits stored in the storage blocks, except for an error block, corresponding to the virtual data blocks belonging to the block plane with one error block; recovering the one error block by comparing XOR operation results with the parity information stored in the storage block corresponding to the parity block for the block plane; and repeating the above recovering operations in regular order of the X, Y and Z-coordinates.

As per Claim 13, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** machine readable storage comprising multiple disk drives each comprising a plurality of storage blocks, the storage comprising: a programmed computer processor associating storage blocks of the disk drives to a virtual three-dimensional block matrix of virtual data blocks with virtual parity blocks allocated to each virtual data block plane, and controlling data input/output to/from the disk drives.

As per Claim 14, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** storage of claim 13, wherein the programmed computer processor further calculates parity information based upon the data bits respectively stored in the storage blocks corresponding to the virtual data blocks of each virtual data block plane.

As per Claim 15, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** storage of claim 13, wherein the programmed computer processor further recovers any number of error blocks in the storage blocks according to the virtual parity blocks corresponding to each virtual data block plane.

As per Claim 16, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** storage of claim 13, wherein the programmed computer processor generates the virtual three-dimensional block matrix by calculating a maximum integer M satisfying K.gtoreq.M.sup.3+3M, where K is the total number of storage blocks of the disk drives, M.sup.3

is a number of the storage blocks used as data blocks, and 3M is a number of the storage blocks used as parity blocks, and the three-dimensional block matrix is M.times.M.times.M. **As per Claim** 17, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** storage of claim 15, wherein the programmed computer processor recovers the error blocks by repetitively: counting a total number of the error blocks occurring in the virtual data block planes, respectively, skipping the virtual data block planes with no error blocks or with two or more error blocks, performing an exclusive OR (XOR) operation between the data bits stored in the storage blocks, except for an error block, corresponding to the virtual data blocks belonging to the virtual data block plane with one error block, and recovering the one error block by comparing the XOR operation results with the parity information stored in the storage block corresponding to the virtual parity block for the virtual data block plane. **As per Claim** 18, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** storage of claim 13, wherein the programmed computer processor associates the storage blocks of the disk drives to the virtual three-dimensional block matrix by: determining a number of the storage blocks to be used as data blocks and a number of the storage blocks to be used as parity blocks in a total number of storage blocks of the disk drives, generating the three-dimensional block matrix of the virtual data blocks corresponding to the determined number of the storage blocks to be used as the data blocks on Cartesian coordinates (X, Y, Z), allocating the virtual parity blocks to the virtual data block planes related to the X, Y and Z-coordinates of the three-dimensional block matrix, respectively, allocating the virtual data blocks and the virtual parity blocks to the storage blocks of the disk drives, respectively, calculating parity information based upon the data bits respectively stored in the storage blocks corresponding to the virtual data blocks of every virtual data block plane, and storing the calculated parity information in the storage blocks corresponding to the virtual parity blocks for

every virtual data block plane, respectively.

As per Claim 19, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** machine readable storage system, comprising: a redundant array of independent disks (RAID) comprising disk drives each having a plurality of storage blocks; a host computer processing data and requesting data input/output of the disk drives; a controller in communication with the host computer and the RAID, and controlling the RAID operations according to a process of associating storage blocks of the disk drives to a virtual three-dimensional block matrix of virtual data blocks with virtual parity blocks allocated to each virtual data block plane.

As per Claim 20, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** system of claim 19, wherein the controller further calculates parity information based upon the data bits respectively stored in the storage blocks corresponding to the virtual data blocks of each virtual block plane.

As per Claim 21, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** system of claim 19, wherein the controller further recovers any number of error blocks in the storage blocks according to the virtual parity blocks corresponding to each virtual data block plane.

As per Claim 22, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** method, comprising: allocating storage blocks of disk drives according to a virtual three-dimensional block matrix of virtual data blocks and virtual parity block planes corresponding to each virtual data block plane to store data and parity information in the storage blocks of the disk drives; and using the virtual parity plane and the corresponding virtual data block plane to recover any number of error blocks in the corresponding allocated storage blocks.

As per Claim 23, **Amelia discloses, in Fig. 2 and related description, equivalent**

multidimensional machine readable storage comprising multiple disk drives each comprising a plurality of storage blocks, the storage comprising: a programmed computer processor associating storage blocks of the disk drives to a virtual three-dimensional block matrix of virtual data blocks with virtual error information blocks allocated to each virtual data block plane, and recovering any number of error blocks in the storage blocks according to the error information blocks corresponding to each virtual data block plane.

As per Claim 24, **Amelia discloses, in Fig. 2 and related description, equivalent multidimensional** machine readable storage comprising multiple disk drives each comprising a plurality of storage blocks, the storage comprising: a programmed computer processor recovering three or more error blocks of the storage block per one parity group calculated for error recovery.

CONCLUSION

* Any response to this action should be mailed to:

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or faxed to: (571) 273-8300 for all formal communications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Guy J. Lamarre, P.E., whose telephone number is (571) 272-3826. The examiner can normally be reached on Monday to Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert De Cady, can be reached at (571) 272-3819.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (571) 272-3609.

Information regarding the status of an application may also be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is

available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Guy J. Lamarre, P.E
Primary Examiner
6/26/2006